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Detection of forced convection regimes using the air temperature sensor of REMS: air and ground skin temperature modulations induced by the wind at Gale

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The air temperature sensor (ATS) of the Rover Environmental Monitoring Station (REMS) on the Curiosity rover consists of two fins located at the rover mast pointing at different orientations separated by 120º. Each fin has three temperature sensors that monitor the variation of the temperature profile from its base, through an intermediate point. This peculiar design has been proposed to cope with the hard restrictions induced by the REMS instrument location on board the rover. The temperature of the fluid in the vicinity of the rover can be retrieved by an algorithm that uses temperature profile samples at the three points in each fin.

The ATS is mounted on two booms with electronics in the rover mast and then is thermally coupled to the whole structure of the warm rover and subject to a strong thermal contamination. Nevertheless it has been designed to cope with this and provide the cleanest possible estimate of the temperature of the fluid around the rover.

The temperature profile through the fins decreases almost exponentially with a factor m that increases with forced convection caused by the wind. This m parameter provides very valuable wind regime information. In particular it shows anticorrelation with ground temperature modulations measured by the Ground Temperature Sensor (GTS) in REMS, as expected if the skin temperature of the ground is cooled down by forced convection. Here we present the detection of convection regimes changes using ATS and GTS REMS measurements.